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RESEARCH ON TACTICAL MILITARY DECISION
MAKING: APPLICATION OF A DECISION
PREDICTION CONCEPT IN A SIMTOS
ENVIRONMENT

James E. Robins, et al

Bunker-Ramo Corporation

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13. ABSTRACT <p>The present experiment was conducted to determine whether predictors of decision quality established in a prior experiment--based on academic achievement and information processing strategy--maintained their effectiveness in a defensive planning scenario incorporating a fully computerized information retrieval capability. A test scenario for defensive planning was developed and administered individually to 20 senior field grade officers, four at a time. Access to data base and presentation of stimulus material were fully automated. Each officer, assuming the role of a G3 operations officer, planned a division defense, in sector, against an expected attack by two mechanized infantry aggressor divisions. Decision quality was scored according to standards developed by the USCGSC at Fort Leavenworth. Nine predictors selected in a prior experiment were included in the present analysis. These were based on an individual's career experience, his academic records in staff college, the information processing and assimilation strategy he uses, and number of relevant facts obtained in processing tactical information.</p> <p>Four predictors maintained substantial predictive stability in the present SIMTOS environment (yielding a multiple correlation coefficient of .79 which reduced to .59 where corrected for shrinkage): 1) Recency at CGSC; 2) CGSC class standing; 3) Information request slope, the number of information requests made by the officer early in the decision-making process in relation to decision quality; and 4) Terminal pause, the time between final information request and decision. Predictors demonstrated their effectiveness in a static tactical planning situation. Final determination of the utility of the predictor concept awaits its application in a simulated combat environment.</p>		

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ARI Research Reports and Technical Papers are intended for sponsors of R&D tasks and other research and military agencies. Any findings ready for implementation at the time of publication are presented in the latter part of the Brief. Upon completion of a major phase of the task, formal recommendations for official action normally are conveyed to appropriate military agencies by briefing or Disposition Form.

FOREWORD

The research reported here was accomplished by the Systems Integration and Command/Control Technical Area of the U. S. Army Research Institute for the Behavioral and Social Sciences. The Institute, established 1 October 1972 as replacement for the U. S. Army Manpower Resources Research and Development Center, unifies in one enlarged organization all OCRD activities in the behavioral and social sciences area, including those previously conducted by the former Behavior and Systems Research Laboratory (BESRL) and the Motivation and Training Laboratory (MTL).

The Command and Control Work Unit within the Army Research Institute (ARI) is concerned with human factors problems of information presentation, processing, and utilization in command and control systems. One major objective is to provide research findings by which information assimilation and decision making may be facilitated. There is a concomitant requirement for research to determine how human abilities can be utilized to enable the command information processing system to function with enhanced effectiveness.

Basic to research on command information systems are relevant and objective performance measures for use in identifying factors contributing to the overall success or failure of the system and in assessing the capabilities of system or subsystem. The present Technical Paper describes research in which predictors of decision quality and criterion scoring methods developed in an earlier experiment were examined in a defensive planning scenario incorporating a fully computerized information retrieval capability.

ARI's Command and Control Systems research is conducted as an in-house research effort augmented by research contracts with organizations selected as having unique capabilities for research in the area. The present experiment was conducted by personnel of the BUNKER-RAMO Corporation. The entire research effort is responsive to requirements of RDTE Project 2Q062106A723, Human Performance in Military Systems, FY 1973 Work Program, and to special requirements of the Assistant Chief of Staff for Force Development, the Assistant Chief of Staff for Intelligence, and the U. S. Army Computer Systems Command.



J. E. UHLANER
Technical Director

RESEARCH ON TACTICAL MILITARY DECISION MAKING: APPLICATION OF A DECISION PREDICTION CONCEPT IN A SIMTOS ENVIRONMENT

BRIEF

Requirement:

To determine whether predictors of decision quality established in a prior experiment--based on academic achievement and information processing strategy--maintained their effectiveness in a defensive planning scenario, incorporating a fully computerized information retrieval capability.

Procedure:

A test scenario for defensive planning was developed and administered individually to 20 senior field grade officers, four at a time. Access to data base and presentation of stimulus materials were fully automated. Each officer, assuming the role of a G3 operations officer, planned a division defense, in sector, against an expected attack by two mechanized infantry Aggressor divisions. Decision quality was scored according to standards developed by the USCGSC at Fort Leavenworth.

Nine predictors selected in a prior experiment were included in the present analysis. These were based on an individual's career experience, his academic records in staff college, the information processing and assimilation strategy he uses, and number of relevant facts obtained in processing tactical information.

Findings:

Four predictors maintained substantial predictive stability in the present SIMTOS environment (yielding a multiple correlation coefficient of .79 which reduced to .59 where corrected for shrinkage):

1. Recency at CGSC.
2. CGSC class standing.
3. Information request slope, the number of information requests made by the officer early in the decision-making process in relation to decision quality.
4. Terminal pause, the time between final information request and decision.

Utilization of Findings:

Predictors demonstrated their effectiveness in a static tactical planning situation. Final determination of the utility of the predictor concept awaits its application in a simulated combat environment.

V.

RESEARCH ON TACTICAL MILITARY DECISION MAKING: APPLICATION OF A
DECISION PREDICTION CONCEPT IN A SIMTOS ENVIRONMENT

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RESEARCH ON TACTICAL MILITARY DECISION MAKING: APPLICATION OF A DECISION PREDICTION CONCEPT IN A SIMTOS ENVIRONMENT

BACKGROUND

Management information systems, if judiciously employed, can appreciably reduce human information handling requirements and expedite decision making during the military command and control process. The Systems Integration and Command/Control Technical Area of the U.S. Army Research Institute for the Behavioral and Social Sciences (ARI) is engaged in a phased research project in which tactical decision making among military commanders and their staffs is investigated. The ultimate goal of the research is to relate tactical information requirements and the decision process empirically to effective command and control of Army forces in the field. The present experiment is the second of a series directed toward the overall goals of the research project.

The first experiment in this series established several promising measures of decision-making quality for prospective use as predictor variables in future experimentation. Results demonstrated that tactical decision quality might be effectively predicted by a composite of a subject's career experience, staff college academic records, information processing and assimilation strategy (his decision process pattern), and possibly the number of relevant facts he obtained as he processed tactical information presented to him.¹ The purpose of the present experiment, the second in the series, was to provide an additional test of the hypothesis that decision quality can be predicted by the measures developed in the prior experiment.

The second experiment was not an exact replication of the first. A procedural difficulty encountered during the initial experiment and verified by subsequent data analysis suggested that exact replication was impractical. In an effort to improve the test situation and eliminate possible extraneous influences from the experiment, modifications were made in experimental materials, the test area, and the experimental procedures for the second experiment.

PURPOSE OF THE PRESENT EXPERIMENT

Predictors of decision quality developed in the earlier experiment were reexamined against a background of an extended defensive scenario

¹ Krumm, R. L., J. E. Robins, and T. G. Ryan. (Bunker Ramo Corporation) Studies of tactical military decision making: III. Predictor variables and criterion measures. ARI Technical Research Note 229. March 1973.

which incorporated a fully computerized data retrieval capability. In the first experiment, nine predictors were selected from a large predictor population for inclusion in a multiple regression analysis. These nine predictors were retained for inclusion in the current experiment. Since it was anticipated that automation of the data retrieval process might render previously defined predictors less sensitive, it was decided to use the data from the current experiment to further select the best set of predictors from the nine.

SCENARIO FOR THE PRESENT EXPERIMENT

In both experiments, each subject assumed the role of a G3 Operations Officer. He was asked to develop a plan for the defense of a U.S. Mechanized Division sector against an attack by an Aggressor task force of two divisions. In each of the two experiments, 20 subjects completed specific decision tasks. In the first experiment, the tasks were: Recommendation of a Form of Defense, Maneuver Concept, Task Organization, and Mission Directives to Subordinate Brigades. In the second experiment, one planning task, Recommendation of a Form of Defense, which had failed to discriminate among earlier subjects, was dropped from the scenario. Another, Mission Directives to Subordinate Brigades, was retained for continuity but not scored.

The tactical planning situation incorporated into the scenario was based on Army Command and General Staff College (CGSC) lesson plan materials. Standards for evaluating decision responses were also provided by CGSC, these having been developed over the past fifteen years.

For the present experiment, the defensive planning situation was extended to include a combat phase, in order that predictor stability might be tested in a dynamic situation. Approximately 3,500 tactical messages were carefully screened with the assistance of CGSC instructors. Fifty messages were selected for inclusion in the scenario, constituting the combat phase (See Appendix A for samples). Individual messages were transmitted to the subject at specified times during the pre-combat or combat phases of scenario execution. Each was typed out on a typewriter located in the subject's test station. The typewriter served the same function during the experiment as a teletype machine does in a division tactical operations center. Modifications in the scenario were reviewed by CGSC instructors to determine the potential impact on the validity of the overall tactical situation. It was concluded that these modifications would neither affect the internal consistency of the tactical situation nor invalidate the earlier scoring protocols.

At the start of the tactical problem, units of the 20th Mechanized Division were in assembly areas just west of the Hof Gap sector of Germany. The subject, assuming the role of the G3, was informed via excerpts from a Corps Operations Order (OFORD) that U.S. Intelligence was aware of an Aggressor build-up along a front that included the 20th Mechanized Division sector, to the east (Appendix B). During the later stages of planning, pre-combat messages began arriving at the subject's typewriter. These messages indicated that a general movement of

Aggressor forces was taking place along the eastern boundary of the U.S. Mechanized sector, an international border.

Shortly after the subject completed the operational planning phase of scenario play, he received an "H-hour" message indicating that the enemy had begun an artillery bombardment along the international border. Thereafter, the messages indicated heavy pressure on the 20th Mechanized Division delaying forces on the general outpost line. Incoming messages from commanders and staff personnel of Division subordinate units depicted a gradual fallback to the west from the first delaying position, to a second delaying position, then to a third. Finally, Aggressor forces penetrated beyond "maximum allowable forward defense area penetrations." It was theorized that this latter event would provide a convenient end-point for scenario play because it would normally cause the subject to counterattack and commit the Division reserve.

AUTOMATION OF THE DATA RETRIEVAL PROCESS

In the first experiment, test subject access to the tactical information stored in the computerized data base was by means of a "computer operator." Requests for unusual kinds of information confronted the computer operator with a decision situation of his own. He was required to decide whether to send the subject an "information not available" display or a display assumed to meet the requirements of the request even though applicability was uncertain. In the latter case, the subject might obtain information he had not intended to review. In addition, the computer operator might respond to a similar request from another subject with different displays.

In order to gain more effective control over the experimental situation, new data retrieval procedures were devised. This new retrieval program was designed around three general principles:

1. Subjects must be able to access the computer data base without aid of a computer operator and with a negligible amount of training.
2. Indexing and retrieval patterns must enable the subject to maintain contact with previously reviewed information without starting from the original index display each time.
3. The retrieval program must restrict the tendency of subjects to review the entire data base rather than to adopt a retrieval strategy.

Data Retrieval Procedure

Test subjects were able to access the tactical information stored in the computer by activating a few simple controls on the CRT keyboard (Figure 1). The information was arranged in the computer so as to enable the subject to review and select categories and subcategories of tactical data to successive levels of detail until he obtained a desired element of information.

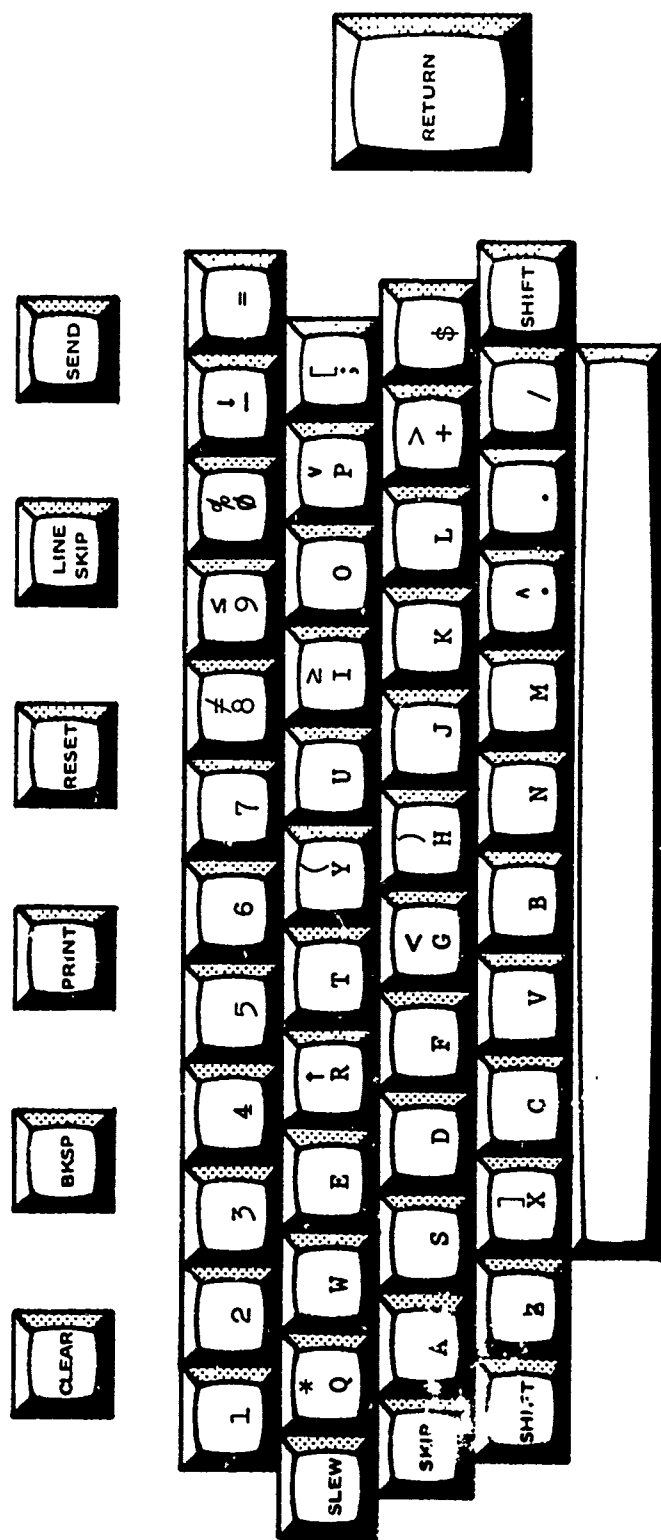


Figure 1. CRT keyboard used in the current experiments

Each display appearing on the face of the CRT was divided into a top half and a bottom half. The top half displayed either an information index or tactical data elements. The bottom half displayed options available for the subject's next move as well as instructions for carrying out the desired retrieval. For example, the first display the subject saw was the following:

- | | |
|----------------------|-------------------------|
| (1) G1 PERSONNEL | (6) FIRE SUPPORT (FSCE) |
| (2) G2 INTELLIGENCE | (7) CHEMICAL (CBRE) |
| (3) G3 OPERATIONS | (8) SIGNAL |
| (4) G4 LOGISTICS | (9) TRANSPORTATION |
| (5) G5 CIVIL AFFAIRS | (0) ENGINEER |
-

() ENTER NUMBER OF ABOVE CATEGORY DESIRED, AND PRESS SEND
BUTTON

If information on G2 intelligence was desired, the subject simply pressed the "2" key and then pressed the SEND button. The following display then appeared:

G2 REPORTING SIR. G2 INFORMATION IS ORGANIZED AS FOLLOWS:

- (1) GENERAL ENEMY SITUATION
 - (2) ENEMY ORDER OF BATTLE
 - (3) WEATHER FORECASTS
 - (4) TERRAIN ANALYSIS
 - (5) STANDARD 16 CAA MECH DIV EQUIP ALLOWANCES
 - (6) AGGRESSOR MOVEMENT TIMES TO BORDER
 - (7) ENEMY CAPABILITIES
 - (8) ENEMY TACTICS
-

() ENTER NUMBER OF ABOVE CATEGORY DESIRED, OR ENTER LETTER
OF ONE OF FOLLOWING OPTIONS, AND PRESS SEND BUTTON.

- A. RETURN ME TO ORIGINAL DISPLAY.
- B. RETURN ME TO PREVIOUS DISPLAY.

In this particular display, if the subject selected either A or B, the result was the display previously described. On the other hand, if more information was desired about enemy order of battle, the subject pressed the "2" key and then the SEND button, and the following display appeared:

ENEMY ORDER OF BATTLE 16 CAA

- (1) 550 MIXED ARTY BDE
 - (2) 68 AAA REGT
 - (3) 207 RL REGT
 - (4) 1st F MECH DIV
 - (5) 34 MECH DIV
 - (6) 35 MECH DIV
-

() ENTER NUMBER OF ABOVE CATEGORY DESIRED, OR ENTER LETTER OF ONE OF FOLLOWING OPTIONS, AND PRESS SEND BUTTON.

- | | |
|----------------------------------|--------------------------------|
| A. RETURN ME TO ORIGINAL DISPLAY | E. PERSONNEL STATUS |
| B. RETURN ME TO PREVIOUS DISPLAY | F. WEAPONS STATUS |
| C. ABOVE UNIT LOCATION | G. ELECTRONIC EQUIPMENT STATUS |
| D. CURRENT ACTIVITY | H. MOBILITY EQUIPMENT STATUS |

If the subject desired more information about the 207 Rocket Launcher (RL) Regiment, he pressed Key 3 and then the SEND button to call up the following display:

TASK ORGANIZATION 207 RL REGT
HQ BTY

- 1-207 RL REGT
 - 2-207 RL REGT
 - 3-207 RL REGT
-

NO FURTHER DATA AVAILABLE IN ABOVE CATEGORY, SIR.

() ENTER LETTER OF ONE OF FOLLOWING OPTIONS, AND PRESS "SEND" BUTTON

- A. RETURN ME TO ORIGINAL DISPLAY
- B. RETURN ME TO PREVIOUS DISPLAY

As the subject continued to trace through his retrieval pathways, he was provided information in greater detail.

It was possible for the subject to make errors of three types as he manipulated the CRT keyboard:

1. He might press the SEND button without having made a letter or number entry.

2. He might press the SEND button after having entered an invalid number or letter key. For example, in the above set of retrieval instructions, any number or letter other than A or B would be considered invalid.

3. He might inadvertently press a button that advances the cursor out of position to enter and send the desired entry.

When the subject made any of these errors, the following ERROR message appeared on the CRT screen:

ERROR MESSAGE

YOU HAVE MADE AN ERROR SIX. PRESS SEND BUTTON TO

RECALL LAST DISPLAY

ERROR MESSAGE

If the subject realized that he had made an error before he pressed the SEND button, he could correct the error simply by pressing the BKSP (backspace) key which places the cursor in proper position, then pressing the key for the proper entry and then the SEND button.

Modification of Display Modes

Change to CRT Presentation. During the first experiment, several methods of displaying information were used. Certain kinds of information appeared only on the face of the cathode ray tube. More complex displays were sent to the display surface of a random access slide projector (RASP). If the subject wished, information viewed on the CRT could also be requested to appear in hard copy format on the typewriter. Hard copy versions of RASP displays were hand carried to the subject by the experimenter upon request.

From an operational viewpoint only, use of the three separate methods of data presentation greatly facilitated the retrieval of tactical information. From an experimental viewpoint, however, it was often difficult to equate information requests with information actually utilized by each subject. The difficulty of relating information display to use of information was partly a function of bonus information being provided to subjects on RASP displays. A RASP display depicting maintenance of unit

Date/Time

080630 Oct 68

MAINTENANCE OF UNIT STRENGTH - 20 MECH DIVISION

ASSIGNED UNITS

UNIT	<u>AUTHORIZED STRENGTH</u>			<u>ASSIGNED STRENGTH</u>		
	OFF	EM	AGGR	OFF	EM	%
1st BDE	106	1619	1725	84	1256	77.7
2D BDE	224	3973	4197	174	3089	77.7
3D BDE	108	1950	2058	91	1524	78.5
DIV BASE	447	5659	6106	397	5504	96.6
DIV TRP	40	895	935	36	704	79.1
DIVARTY	227	2868	3095	227	2868	100.0
TOTAL	1152	16964	18116	1009	14945	88.1

ATTACHED UNITS

UNIT	<u>AUTHORIZED STRENGTH</u>			<u>ASSIGNED STRENGTH</u>		
	OFF	EM	AGGR	OFF	EM	%
2-631 Arty	31	647	678	31	647	100.0
TOTAL	31	647	678	31	647	100.0

Figure 2. Typical RASP display from first experiment

strength appears as Figure 2. If the subject received this display in response to a request for the percentage of persons available for duty in the 1st brigade, it can be seen that he would obtain considerable additional information. The display provides the requested information not only for the 1st brigade, but also for all assigned and attached units. In addition, the display lists authorized and assigned strengths for each of these units.

In order to gain more adequate experimental control, RASP displays were eliminated as a means of data display in the second experiment. The information contained in these displays was reformatted for presentation on the CRT. Examples of the manner in which information appearing in the RASP display shown in Figure 2 was reformatted for recall and review on the CRT follow:

PERSONNEL STATUS 1ST BDE

OFF	EM	TOTAL
84	1256	1340

PERSONNEL AUTHORIZED 1ST BDE

OFF	EM	TOTAL
106	1619	1725

PERSONNEL EFFECTIVE PERCENT

UNIT	PERCENT
1ST BDE	77.7

Output Typewriter. The ability to obtain hard copy output of data appearing on the CRT at the typewriter was also eliminated. The typewriter was used in the present scenario as a means of presenting pre-combat and combat messages to the test subjects only. Thus, the CRT display was the only means by which the subject could request and review the tactical information stored in the computer.

Reduction of Bonus Information. Bonus information appeared in CRT displays as well as in RASP displays in the first experiment. In order to eliminate this condition, tactical information was arranged in the computer files in progression from general to specific detail, and each CRT display was reformatted to consist of a minimal number of "facts," or elements of information. It was not feasible to adhere strictly to presentation of one fact per CRT display. Rigid conformity to such a rule would have resulted in an unnecessarily detailed data base. Whenever a subject reviewed such a display, it was assumed that all information included in the display was used in the decision making process.

Repackaging the tactical information included in the original defensive scenario generally took the form of reducing factual statements to single simple sentences such as:

REQUISITIONS DIVISION WIDE FOR 143 OFFICERS, AND 2019 ENLISTED MEN WERE OUTSTANDING AT THE CLOSE OF THE PERIOD.

REPLACEMENTS NECESSARY TO GET MANEUVER UNITS UP TO STRENGTH NOT AVAILABLE FOR AT LEAST 10-15 DAYS.

METHOD

Test Subjects

The following guidelines were set for selection of subjects. They were to be graduates of the U.S. Army Command and General Staff College (CGSC) at Fort Leavenworth, Kansas. They should have had experience as Commander, Assistant Division Commander, Chief of Staff, or G3 in a mechanized infantry division, or as Commander, Executive Officer, or S3 in a mechanized infantry brigade. These were the same standards as for the first experiment. As in the first experiment, however, these standards were not fully achieved. For example, four of the participants had not attended CGSC but rather had graduated from the Armed Forces Staff College. The rest of the requirements were met in varying degree, and one subject had attended both CGSC and the Army War College. Nineteen lieutenant colonels and one colonel participated in the experiment. All were on active duty status in the greater Washington area. Their ages ranged from 34 to 44 with a modal age of 38. All were college graduates and eight had attended graduate school. Sixteen had graduated from CGSC (three within the past two years, eight four years ago, four six years ago, and one over ten years ago) and four had not attended CGSC. Nine subjects had had experience in Europe, three in Korea, and twelve in Vietnam. It was not determined, except for the Vietnam experience, whether this was combat experience. With respect to exercises in West Germany, advanced troop test experience was reported by six subjects, command post exercises by ten, field training exercise by twelve, and map exercise training by ten.

Test Area and Experimental Cubicles

During the first experiment, participation was limited to a single subject per experimental session. In the present experiment, four subjects could be tested at one time. The experimenter's station was centrally located in the laboratory so that the experimenter had easy access to each of the subject stations (Figure 3).

Subject Test Stations. Each subject test station included the following equipment:

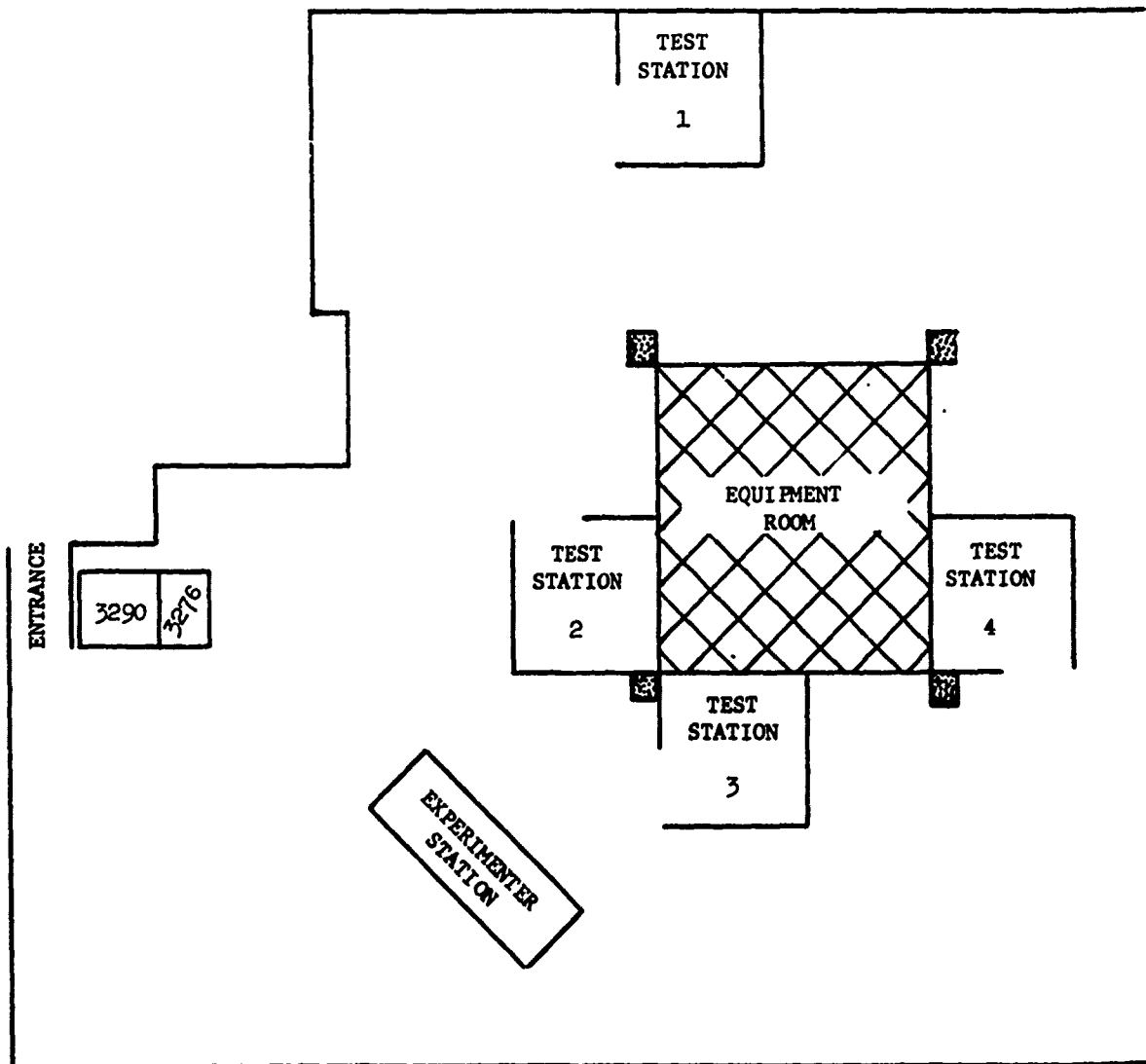


Figure 3. Configuration of laboratory test area

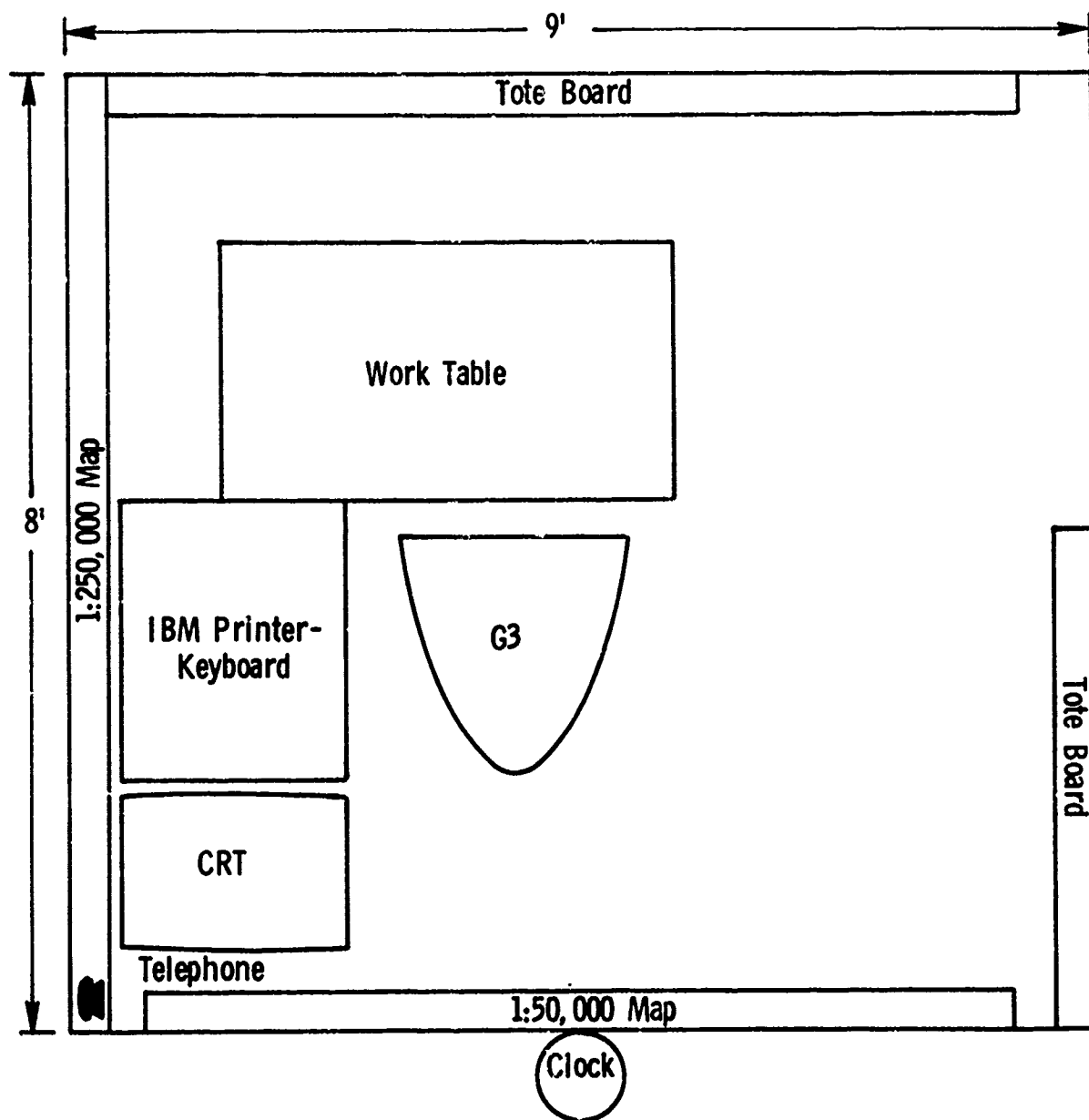


Figure 4. Configuration of subject test station equipment



Figure 5. Simulated DTIC



Cathode ray tube display device
Output typewriter
Work table, 3' X 4'
Swivel chair
1:250,000 planning map, small, wall mounted
1:50,000 situation map, large, wall mounted
Two acetate tote boards
One telephone, intercom
One twenty-four-hour wall clock (electric motor speeded 3:1)
Grease pencil receptacle

Figure 4 shows the configuration of this equipment. Figure 5 shows a subject in one of the stations. The CRT and the typewriter were placed side by side at a 90-degree angle to the 1:50,000 situation map located on the wall just above the CRT and typewriter. This configuration enabled the subject to scan each of his displays with a minimum of effort. The wall maps and tote boards were covered with acetate to enable the subject to make grease pencil notations thereon.

Experimenter Station. The experimenter station (Figure 6) contained the following equipment:

Cathode ray tube
Work table (3' X 4')
Swivel chair
Storage cabinet, table height
Acetate overlays (4 depicting avenues of approach, 4 key terrain, and 4 containing commander's recommendations)
Clock control panel

The experimenter was provided with capability to transmit instructions to the computer via the input keyboard on his CRT display console. He was also able to monitor information being reviewed at a particular subject station. The computer also maintained a chronology of subject information retrieval activities during the experiment.

A master control panel provided separate control of individual clocks. As necessary, all the clocks could either display the same time, or each clock could display a separate time. The 3:1 speed ratio of the electric clock motor allowed every twenty minutes (real time) to represent one hour.

Test Procedure

Subjects participated in the simulation in groups of up to four. Participants were escorted to the test area, briefed on equipment operation, and familiarized with the operational task requirements. Each subject was told to assume that he was the new G3 of the 20th Mechanized Division on alert status in an assembly area in Germany. The implications were that he could expect trouble from an aggressor. However, no contingency plans were available. He was told that he would receive his first instructions by excerpts from a Corps OPORD and from a memorandum issued by the commander of the 20th Mechanized Division.

The subject was told that he might need information stored in the computer to accomplish his G3 tasks. He was also told that he would be able to obtain this information without the aid of a computer operator by following the instructions that would appear on the bottom half of his display screen. If he found that incoming messages on the typewriter caused a need for information from other staff elements, he was instructed to request the information from the computer also.

Upon completion of the briefing, each subject was provided with excerpts from a Corps OPORD (Appendix B). The Corps OPORD described the Corps situation in terms of enemy and friendly forces and outlined the Corps mission, including execution and concept of operations. The subject also received a memorandum from the commander of the Division providing guidance for preparing the G3 staff estimate (Appendix C). The memorandum provided guidance regarding a form of defense to be employed, the Division mission, and a directive for the subject to prepare a G3 presentation for a commander's briefing to be held the morning of the following day. The participant also received three response forms at this time. Response Sheet I requested the participant to write out his allocation of combat power to the echelons of defense. Response Sheet II required him to delineate the task organization he expected to employ to achieve the mission. Response Sheet III required him to write out his missions to subordinate brigades.

After each subject was situated in a test station, the experimenter returned to his CRT, sent the General Index to each test station, and activated the test station clocks. Transmission of the General Index to each subject station was recorded on disk and later used to determine subject start time. All succeeding activities were logged as so many minutes from General Index.

The subject then proceeded to complete G3 planning Response Sheets I, II, and III, with assistance of tactical information retrieved from the computerized data base. During the planning period, ten Spot Reports were sent to the subject's typewriter. The primary purpose of these messages was to accustom the subject to reviewing the typewriter messages. In addition, the messages provided a general indication that the enemy was increasing his activity along the international border. When each subject signified that he had completed planning, he was given a one-hour break.

When the subject returned from the break, he found an acetate overlay on his situation map, depicting the commander's assessment of the current tactical situation and recommendation for conduct of the defense of the Division sector.

After the subject had been given the task requirements for the combat phase, the experimenter once again sent the General Index to the subject station. Five minutes later, the subject received a flash message signaling the start of the combat portion of scenario play. The

subject then completed counterattack planning requirements and initiated remedial action in response to a scheduled series of combat messages.

During the combat phase, the subject was required to develop three separate counterattack plans. Each counterattack plan was to include 1) assumptions, 2) counterattack mission, 3) execution, 4) concept of operations, 5) coordinating instructions, and 6) a graphic portion to be drawn on the planning map to show intended line of departure and objective for each plan. One counterattack plan was developed for the first brigade, one for the second brigade, and one for a possible airborne assault to the Division rear.

At the end of the experiment, each subject was requested to complete a questionnaire (Appendix D) concerning his military experience and his civilian and military education. The entire group of subjects was gathered together after the questionnaires had been completed. Debriefing included a definition of the research goals of the experiment and provided opportunity for the subjects to comment on scenario design, test facility configuration, and overall conduct of the experiment.

RESULTS

Subject experience, achievement, and information retrieval component variables that maintained their stability during execution of the revised tactical scenario were entered into a multiple regression analysis with decision response scores. Scoring of subject protocols, e.g., information requests and decision responses, was limited to the planning portion of the scenario. The combat portion of the scenario progressed solely on the basis of tactical messages output on the subject's typewriter. The computerized data base was not maintained current with the typewriter messages. Information requests were therefore discontinued after the first few minutes of combat play by the majority of subjects. Consequently, counterattack planning and reserve force commitment responses could not be related to discernible information search indices.

Analysis of Criterion Scores

Subject response forms and graphic map drawings developed during the planning phase of scenario execution were scored independently by two members of the research team. The a priori standards outlined in Appendix E (Leavenworth standards) were used to translate subject responses into raw score points. The two independently derived sets of raw scores were then tested for interjudge reliability by means of an analysis of variance technique described by Winer.² Sources of variation between the two sets of data appear in Table 1.

² Winer, B. J., Statistical Principles in Experimental Design, McGraw-Hill, New York, 1962, pp. 127-132.

Table 1

ANALYSIS OF VARIANCE--CRITERION SCORES

Source of Variation	Sum of Squares	Degree of Freedom	Mean Square
SS Between Subjects	1620	19	87.9
SS Within Subjects	91	20	4.6
SS Between Judges	3	1	3.0
SS Residual	88	19	4.6
SS Total	1711	39	

The estimate of reliability is provided by:

$$r^2 = 1 - \frac{\text{MS within Subjects}}{\text{MS between Subjects}}$$

The resultant interjudge reliability estimate was .95. Therefore, the two sets of raw scores were averaged by subject, yielding a single set of criterion scores. This set of scores ranged from a high of 36 to a low of 15, out of a maximum total of 59.

Analysis of Predictor Scores

Nine predictors of decision quality developed in the first experiment were tested again in the present analysis. The first five variables in Table 2 describe a subject's military experience and academic performance as defined by Leavenworth standards. The last four variables represent the strategy applied by the subject as he retrieved information from the computerized data base. The nine predictors were evaluated in the present analysis by computing product-moment correlation coefficients between predictors and criterion scores. Resulting correlation coefficients were then compared with those obtained during the first experiment (Table 2).

Components that maintained their predictive stability during the present experiment were Recency at CGSC (EL), CGSC Class Standing (ALC), Information Request Slope (PRS), and Terminal Pause (PTP). Scores derived on each of these predictors were entered into a multiple regression analysis with the criterion scores (Table 3). The multiple correlation coefficient was .79 ($P < .05$). Corrected for shrinkage, the multiple correlation coefficient becomes .59.

Table 2

PRODUCT-MOMENT CORRELATION BETWEEN NINE PREDICTORS AND THE CRITERION

Predictor	First Experiment N = 20	Second Experiment N = 20
Recency of graduation from CGSC (EL)	.20	.60
Experience in Mechanized Infantry (EI)	.43	.05
Experience in exercises in Germany (EX)	.46	-.19
Class Standing at CGSC (ALC)	.47	.29
Expressiveness (CGSC Standard) (ALW)	.42	-.02
Sequence Score (PSEQ)	.53	-.07
Runs Score (PDRR)	.49	-.11
Slope Score (PRS)	.44	.35
Terminal Pause Score (PTP)	.22	.23

Table 3

MULTIPLE REGRESSION WEIGHTS FOR FOUR PREDICTORS

Variable	Regression Coefficient	Standard Error of Coefficient	Beta
EL	.49	.12	.75
ALC	.32	.12	.48
PRS	-.06	.12	-.09
PTP	.15	.09	.28

Multiple Correlation Coefficient = .79; corrected for shrinkage, .59

While these results are encouraging, confirmation of the four-variable predictor of decision performance in a SIMTOS environment must await a complete cross validation of the results.

Relationships Between Number of Facts and Decision Quality

A suspected curvilinear relationship between number of facts obtained by the subject and the criterion measure was reported in the first experiment (See Appendix F for a definition of fact as used herein). In that analysis, high scores on the criterion measure were apparently associated with either fewer or substantially more facts. In the present analysis, an associated scattergram indicated an indeterminate relationship between number of facts and criterion scores. High scores were observed across the entire spectrum of "facts possessed." For example, the four highest criterion scores were associated with 86, 126, 133, and 293 facts. This finding does not negate the possibility that the relationship may exist. However, it is difficult to make a definitive statement regarding the suggested relationship on the basis of an N of 20. Final resolution of this question awaits the inclusion of information on additional subjects in the overall data pool.

Another way of interpreting the facts obtained by a subject is to attempt to determine whether some facts are more "relevant" than others in solving the tactical problems posed in the scenario. The formula $R = (.49 \text{ EL}) + (.32 \text{ ALC}) + (-.06 \text{ PRS}) + (.15 \text{ PTP}) - 18.07$ (See Table 3) was used to predict each subject's decision quality score. A subject's predicted score was compared with obtained criterion score. Subjects whose obtained criterion scores exceeded their predicted scores by 0.3 standard deviation were termed "over-achievers"; those whose obtained scores were 0.3 standard deviation less than their predicted scores were labeled "under-achievers." The facts reviewed by each subject were totaled and facts presented 1.5 times more frequently to over-achievers than to under-achievers were defined as significant.

The FACT score was computed in terms of the percentage of each decision-maker's "facts" which were classified as "significant" divided by the number of "facts" displayed to him. This scoring procedure involves the tacit assumption of equivalence of facts. That is, it is assumed that all significant facts, regardless of category, are of equal value to a decision maker in solving a problem.

As a matter of exploratory interest, the FACT score was included in a five-variable multiple correlation analysis with four selected predictors (EL, ALC, PTP, PRS). Inclusion of the FACT score resulted in substantial increase in the correlation coefficient. However, the FACT score was derived in part from the criterion variable. Nonetheless, the result may indicate that the FACT score can be applied to strengthen the current predictive capability. In order to test this theory, the relevant facts identified in the present experiment will be used to provide an a priori listing of relevant facts for use in succeeding experimentation.

CONCLUSIONS

The present experiment lent support to the stability of the concept developed during the first experiment. The essential postulate of that conceptualization was that tactical military decision quality could be predicted on the basis of a subject's scholastic achievement at CGSC, his experience, and his information retrieval strategy. It also demonstrated the feasibility of developing a fully automated information retrieval--one in which the experimental subjects were able to query their computerized data base from an input/output CRT display without prior training.

Several predictors of decision quality developed during the original experiment withstood the rigors of transferral to automated scenario operations. The predictors of decision quality were modified slightly on the basis of new data obtained in the automated SIMTOS environment; nevertheless, the multiple correlation coefficient between these variables and the criterion was still quite high, .79 (.59 when corrected for shrinkage). Since the predictors applied in the present experiment were analogous to component predictors of decision quality during the first experiment, a tentative validation of the predictor concept has been carried out. The validation is termed tentative because of procedural differences introduced into the experiment by automating the information retrieval process, and also because of the small sample (N=20) on which the analysis was based. The results of the experiment suggest, however, that progress has been made in developing predictors of decision quality that can ultimately serve as dependent variables in systems. This progress in turn means that one of the SIMTOS program goals of linking display design to decision quality has been achieved.

APPENDIXES

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PRELIMINARY MESSAGES

APPENDIX A continued

NAME: WARSAGO, IVAN M.
SER. NO: 212616
UNIT: 100 MM GUN BN DIV ARTY
UNK MECH DIV
TAGGED: 2301

SUBJECT DESERTED FROM HIS UNIT AND WAS PICKED UP BY THE 20 MP CO IN THE TOWN OF HOF (QA0878) AFTER HE HAD SURRENDERED TO LOCAL POLICE. SAYS HIS UNIT CONSISTS OF 20 OFFICERS AND APPROX 450 EM. HIS BN IS LOCATED VIC (US 4010). SAID HE PASSED THROUGH THE LINES OF ONE OF UNKNOWN MECH RFL UNIT. SAID HIS UNIT HAS BEEN ISSUED EXTRA AMMO.

Message #5

FROM: 20 MP CO 142400SEP
TO: G-3 20 MECH DIV
SUBJECT: DESERTER INTERROGATION

NAME: IVANOV, CLETUS
RANK: PVT
SN: 662355
UNIT: B CO
TAG NO: 2502

SUBJECT SURRENDERED TO POLICE AT HOF (QA0878). TURNED OVER TO 20 MP CO SUBJECT IS VERY NERVOUS. COULD ONLY GIVE HIS CO IDENTIFICATION. HE SAID HE HAD HEARD HIS DIVISION WOULD ATTEMPT TO CAPTURE HOF AND SCHWARZENBACH (PA8774). HIS UNIT WAS AT FULL STRENGTH WHEN HE LEFT. HIS UNIT WAS ISSUED 6 DAYS RATIONS BEFORE HE LEFT AND TOLD TO CONSERVE THEM UNTIL ORDERED TO USE THEM. SUBJECT CURRENTLY BEING INTERROGATED BY MID CO.

Message #6

FROM: G-2 3d (US) CORPS 150100SEP
TO: G-2 20 MECH DIV (INFO G-3)

INFORMER REPORTS THAT ORDERS WERE GIVEN 13 SEP FOR SEVERAL GUERRILLA LEADERS TO BE SENT FROM TERRITORY EAST OF WEISSE-ELSTER RIVER INTO 3D (US) CORPS AREA. THEY ARE TO POSE AS REFUGEES. THEY CAN IDENTIFY EACH OTHER BY A MISSING POCKET ON THE LEFT SIDE OF THEIR COATS. THEIR OBJECTIVES HAVE NOT BEEN IDENTIFIED. INFORMER IS ATTEMPTING TO GAIN FURTHER INFORMATION ON GUERRILLA PERSONALITIES AND OPERATIONAL AREAS.

APPENDIX A continued

Message #7

FROM: 20 MECH G-2

150200SEP

TO: 20 MECH G-3

FRIENDLY AGENTS REPORT THAT A LARGE MECH INFANTRY FORCE HAS BEEN OBSERVED MOVING SOUTHWEST VIC (US3105).

Message #8

FROM: 3D (US) CORPS G-2

150300SEP

TO: 20 MECH G-2 (INFO G-3)

FRIENDLY AGENTS REPORT THAT A BN SIZE FORCE WAS OBSERVED MOVING S.W. WITH APC'S, TANKS, AND ARTY FROM VIC (US 2110).

Message #9

FROM: 3D (US) CORPS G-2

150400

TO: 20 MECH DIV G-2 (INFO G-3)

REPORTS COMPILED FROM RELIABLE FRIENDLY AGENTS LOCATED IN AREAS TO THE EAST OF THE WEISSE-ELSTER RIVER INDICATE THAT SEVERAL UNITS OF THE 16 CAA (THE 1ST MECH DIV, THE 34 MECH DIV, AND THE 35 MECH DIV) ARE POSITIONING THEMSELVES ALONG THE INTERNATIONAL BORDER IN LINE WITH 20 MECH DIV POSITIONS. UNITS APPEAR TO HAVE GREATER LOGISTICS SUPPORT THAN NECESSARY FOR MANEUVERS.

Message #10

FROM: 3D (S) CORPS AIRFIELD TIIF

150500SEP

TO: G-2 20 MECH DIV (INFO G-3)

RECON AIRCRAFT HAVE VERIFIED A REPORT BY FRIENDLY AGENTS THAT AN UNUSUAL AMOUNT OF POL IS BEING STOCKPILED IN OELSNITZ (TR 9989). ONE TRAIN COMPOSED OF TANK CARS WAS SPOTTED ON SIDETRACKS IN THE OELSNITZ TRAIN YARD. IN ADDITION 400-500 CIVILIANS WERE OBSERVED UNLOADING POL DRUMS FROM BOX CARS AT RAILROAD SIDING VIC (TR9889).

APPENDIX A continued

H-HOUR MESSAGE

Message #11

FROM: CMDR 3D BDE 160615SEP
TO: CMDR 20 MECH DIV
FLASH! FLASH! FLASH! FLASH!

ALL ELEMENTS ON THE GOP ARE UNDER HEAVY ATTACK. RECEIVING
HEAVY ARTILLERY FIRE AT COORDINATES (TR9787) AND (TR9390).

REQUEST PERMISSION TO DESTROY BRIDGES AT WEISCHLITZ (TR9192),
MAGWITZ (TR9290), AND OELSNITZ (TR9989).

WILL KEEP YOU INFORMED.

POST -H-HOUR MESSAGES

Message #12

FROM: CMDR 3D (US) CORPS 160630SEP
TO: CMDR 20 MECH DIV

57TH DIV REPORTS THEIR SECTOR UNDER HEAVY ARMORED ATTACK.
AGGRESSOR ADVANCE SUPPORTED BY CONSIDERABLE ARTILLERY AND MORTAR FIRE.

Message #13

FROM: 3D BDE G-3 160645SEP
TO: G03 20 MECH DIV

ALL UNITS REPORT CONTACT WITH AGGRESSOR FORCES ALONG THE
ENTIRE GOPL.

Message #14

FROM: S-3 3D BDE 160700SEP
TO: G-3 20 MECH DIV

ENEMY HAS SUCCESSFULLY ESTABLISHED A CROSSING POINT ON THE
WEISSE-ELSTER RIVER VIC (TR9191).

(UNCLASSIFIED)

3D (US) CORPS
KRONACH (PA6668) GERMANY
141800SEP

20th Mech Div
OPORD 63
(Excerpts)

References: Map Western Europe (HOF PLAUEN 1:50,000, GERMANY 1:250,000)

1. CORPS SITUATION

a. ENEMY FORCES

During the past 3 months, the foreign policy of the Circle Trigon Gov't has become hostile toward the US and her allies. This hostility has resulted in increased military activity along the entire Circle Trigon border. This activity is being accomplished under the cover of a normal training schedule.

b. FRIENDLY FORCES

To counter the threat posed by the Circle Trigon build-up, the 30th US Army has been airlifted to the European theater to supplement NATO forces. The 30th (US) Army is occupying positions along the Circle Trigon border with the 1st and 2nd (US) Corps on the north and the 3D (US) Corps in the south.

2. CORPS MISSION

3D (US) Corps to move to defensive positions immediately and defend in sector from REMPTSTENDORF (PB8801) to WEIBENSTADT (QA0654) for a period of 30 days to permit a build-up of NATO forces for a counter-offensive.

3. EXECUTION

a. CONCEPT OF OPERATIONS

(1) Maneuver

Corps to establish defense in sector with the 56th Mech Div on the north, 20th Mech Div in the Center, and the 74th Mech Div in the South. The 56th Armed Division and the 26th (UK) Armed Div Corps Reserve, located VIC NORDHALBEN (PA7883).

APPENDIX B continued

(2) Fires

(a) Air

Priority of close air support to 57th Mech Div, and 74th Mech Div in that order, then to Corps Counterattacking forces on Commitment.

(b) Artillery

Priority to 57th Mech Div, 20th Mech Div, and 74th Mech Div in that order, then to 20 Mech Div counterattacking forces when committed.

(c) Nuclear

The bulk of Corps nuclear weapons will be allocated to the divisions in the FDA. Allocation with authority to dispense and expend will be provided if Circle Trigon forces employ nuclear weapons.

(3) 20 Mech Div

(a) Defend in sector immediately.

(b) Prevent enemy from penetrating west of hills 715(PA8678), 795(PA8873), and 726(PA9066) - on line red.

(c) Establish GOP 150600SEP

(4) 57 Mech Div

(a) Occupy and establish initial delay position along SAALE River in sector.

(b) Establish GOP by 150600SEP

(5) 74 Mech Div

(a) Defend in sector immediately.

(b) Establish GOP by 150600SEP

(c) Prevent enemy from penetrating west of line red

(6) 56th Armd Div

(a) Corps Reserve

(b) Priority of employment to 57th Mech Div sector

(7) 26th (UK) Armd Div

(a) Corps Reserve

(b) Priority of employment to 74th Mech Div Sector.

APPENDIX B continued

(8) ARTY

(a) FA:

- (1) 61st Arty Gp: GSR 20 Mech Div Arty
- (2) 62D Arty Gp: GSR 57 Mech Div Arty
- (3) 63D Arty GP: GSR 74 Mech Div Arty
- (4) 2D Bn (155,SP) 631ST ARTY: ATTCH 20 Mech Div
- (5) 1ST BN (155,SP) 632D ARTY: ATTCH 57 Mech Div
- (6) 3D Bn (155,SP) 634th ARTY: ATTCH 74 Mech Div
- (7) 1ST BN (TGT ACQ), 101st ARTY: GS
- (8) 1ST BN (SGT), 211 ARTY: GS
- (9) BTY A(SGT), 191 ARTY: GS

(b) ADA

- (1) 401st ARTY GP PRIORITY TO CORPS RESERVE, FDA, CORPS
COMMAND POST

(9) 301 CHL BN (SMOKE GENR): GS

- (1) Priority to 20 Mech Div Sector.

(10) 51 ENGR BDE: GS

- (a) 51 ENGR Bde supports 3D (US) Corps defensive operations
employing 56th Engr. Gp. (CBT) on the North, 54th Engr.
Gp (CBT) Center, and 55th Engr. Gp. (CBT) in the south.

- (b) Priority of effort in order, construct corps blocking
positions, preparation of obstacles and road mainten-
ance.

(11) Barrier and Denial

(a) Location Concept

Units will construct obstacles as required to cause maximum restriction to enemy movement. Roads or other high-speed avenues of approach will be blocked in depth. Barriers will canalize enemy attack into killing area.

APPENDIX B continued

(b) Destruction of Population Centers

Destruction of population centers and communications, transportation, utilities, mining, factories and port facilities will be held to a minimum.

(c) Operations requiring Army approval

(1) Use of chemical contaminants requires specific Army approval.

(2) Any destruction that may have strategic impact will require Army approval prior to execution.

(d) Consideration of future operations

Barrier and denial operations must not unduly restrict future Army operations particularly to the north.

(e) Coordinating Instructions

(1) Gaps and lanes in Army directed barriers behind FEBA to be closed only on Army order.

(2) Nuisance mines will not be authorized.

(3) Barrier construction may be initiated without further orders.

Distribution: A

3d (US) Corps

OFFICIAL

/S/ Malone
MALONE
G3

UNCLASSIFIED

APPENDIX C INSTRUCTIONS FOR USE IN THE DEVELOPMENT OF THE G3 ESTIMATE

UNCLASSIFIED

MEMORANDUM

FROM: CMDR 20 Mech Div
TO: G-3 20 Mech Div
SUBJECT: Development of G3 Estimate

141830SEP

You are to prepare a presentation for the 150700SEP Commanders briefing. The briefing is to include the rationale underlying the preparation of the G3 estimate. Base your estimate on the following considerations:

1. Form of Defense:

Considerations of terrain and relative mobility are most significant. The rugged terrain along the SAALE river obstacle provides good cover and concealment, excellent observation of the river valley, and good to excellent fields of fire. Therefore, division planning will proceed on the basis of an area defense.

2. Mission:

(a) Our mission is to defend along the SAALE river line in sector. We must employ a general outpost.

(b) The Corps Commander has not specified the location of the general outpost. Organize the general outpost with sufficient strength to provide at least 24 hours delay and select a suitable location for recommendation to Corps.

3. Organization of Defense Sector:

In order to accomplish the assigned mission, we will organize our defense sector and conduct the defense primarily to retain terrain in the forward defense area taking maximum advantage of the SAALE river obstacle. The ridge formed by hills 715-795-726 must be retained to support Corps counterattack operations. The division reserve must be located where it can block penetrations, counterattack to regain terrain, and add depth to the defense.

4. Course of Action:

In preparing your estimate, your recommended course of action should be based on the enemy capability of attacking in the 20th Div sector with two Mech divisions supported by artillery and air. The enemy may employ tactical infiltration. There are no indications that the enemy will use nuclear weapons.

(a) Standardized division forms have been provided to develop a course of action in the division sector.

(1) Allocate combat power to the echelons of defense:

--GOP

--FDA

--RESERVE

(2) Specific type of resistance by each echelon of defense
(Delay, screen, defend)

5. Graphic Portion of Commanders Briefing:

Indicate on your 1:50,000 map the location of the following:

- (a) GOPL
- (b) COP coordination point
- (c) BDE lateral and rear boundaries and coordinating points
- (d) Visualized FDA BN positions
- (e) Reserve forces location
- (f) Visualized allowable penetrations
- (g) Division-directed blocking positions

Write out on standardized forms provided:

- (1) Suggested 20 Mech Div task organization
- (2) Mission statements to subordinate units

Contact Div commander by telephone when your briefing is complete. In any event, your briefing must be ready by 150630SEP.

Distribution: B

20 MECH DIV

OFFICIAL

UNCLASSIFIED

Gen. B. G. Smith, Commander

APPENDIX D QUESTIONNAIRE COMPLETED BY SUBJECTS FOLLOWING THE EXPERIMENT

SUBJECT QUESTIONNAIRE

NAME _____ ASN: _____ RANK: _____

AGE: _____ YEARS OF ACTIVE MILITARY DUTY: _____

EDUCATION:

1. Circle highest year completed:

Elementary and High School 6 7 8 9 10 11 12
 College 1 2 3 4
 Graduate 1 2 3 4 5

2. Have you attended the US Army Command and General Staff College at Ft. Leavenworth? (Circle one) YES NO

3. If your answer to the above question was YES, how long ago did you attend the college? (Select one)

1. 0-2 years ago
2. 3-4 years ago
3. 5-6 years ago
4. 7-8 years ago
5. 9-10 years ago
6. More than 10 years ago

4. If you attended the US Army Command and General Staff College, what type of class did you attend (Select one)?

1. Full course of instruction
2. Short course of instruction
3. Correspondence Course

5. Have you attended the Army War College at Carlisle Barracks? (Circle one) YES NO

6. If your answer to the above question was YES, indicate the year you graduated. _____

7. Have you ever served in a mechanized infantry unit? (Circle one) YES NO

8. If your answer to the above question was YES, please fill in the information that best described this experience in the appropriate spaces provided below:

<u>TYPE UNIT</u>	<u>JOB RESPONSIBILITY</u>	<u>MONTHS</u> (duration)	<u>LOCATION</u> (country)
Division	1. Commander	_____	_____
	2. Asst. Commander	_____	_____

APPENDIX D continued

<u>TYPE UNIT</u>	<u>JOB RESPONSIBILITY</u>	<u>MONTHS</u> (duration)	<u>LOCATION</u> (country)
	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
Brigade	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
Battle Group	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
Battalion	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
Company	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
Platoon	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer_____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____

APPENDIX D continued

<u>TYPE UNIT</u>	<u>JOB RESPONSIBILITY</u>	<u>MONTHS</u> (duration)	<u>LOCATION</u> (country)
Squad	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer _____	_____	_____
	1. Commander	_____	_____
	2. Asst. Commander	_____	_____
	3. Executive Officer	_____	_____
	4. Operations Officer	_____	_____
	5. Other Staff Officer _____	_____	_____

9. Have you ever participated in ATT, CPX, FTX, or map exercises in West Germany (Circle one) YES NO

10. If your answer to the above was YES, indicate approximate number.

<u>TYPE EXERCISE</u>	<u>NUMBER</u>
1. Advanced troop tests	_____
2. Command post exercises	_____
3. Field training exercises	_____
4. Map exercises	_____

11. In which of the following are you most experienced?

Mechanized Infantry
 "Straight-leg Infantry"
 Armored
 Airborne
 Artillery
 Special Forces

APPENDIX E SCORING PROCEDURE: LEAVENWORTH STANDARDS

Decision-making behavior was measured on the basis of a subject's ability to develop a course of action and division task organization. The subject recommended a course of action for accomplishing the division mission which included allocation of combat power and specification of the nature of resistance to be offered along each avenue of approach. Each subject was also required to outline a task organization that would be appropriate to meet the enemy threat. Subject responses were recorded on acetate overlays and response sheets. These responses were scored in terms of their agreement with optimum solutions identified in CGSC lessons. Arbitrary scoring weights were assigned, depending upon the degree to which subject responses departed from the school solutions. The procedures used in devising the weights assigned to each subject response are described in this section. Scoring values are summarized in the tables appearing at the end of this section.

Course of Action

In developing his course of action, the subject indicated the nature of resistance to be offered (defend, delay, screen) along the general outpost line (GOPL), and in the forward defense area (FDA) of the division sector. He was also required to indicate the combat power (in terms of number and type of battalions) to be allocated to the maneuver elements in each of these areas and to the reserve forces. The subject drew his GOPL on an overlay of the situation map.

Placement of the GOPL was scored by positioning the CGSC overlay on top of the subject's drawing. Differential weights were assigned on the basis of a CGSC rationale which discussed the relative merits of each of several possible locations. The rest of the subject responses were assigned a value of one point or zero points, depending upon agreement with CGSC solutions. The following scores were applied:

GOPL Location - (Map Overlay)	Score
1. Weisse-Elster River	2
2. 15 km forward of FEBA	1
3. 10-12 km forward of FEBA	0
4. All other locations	0
5. Not drawn	0

Degree of Resistance - (Data Collection Forms)

1. 1st Bde <u>defends</u> in north and 2nd Bde <u>defends</u> in south	1
2. 1st Bde <u>delays</u> in north and 2nd Bde <u>delays</u> in south	0
3. 1st Bde <u>screens</u> in north and 2nd Bde <u>screens</u> in south	0
4. GOP forces <u>delay</u>	1
5. GOP forces <u>screen</u>	0
6. GOP forces <u>defend</u>	0

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Combat Power - (Data Collection Forms)

Score

- | | |
|--|---|
| 1. GOP | |
| a. 2 battalions | 1 |
| b. Other configurations | 0 |
| 2. FDA | |
| a. 4 battalions in the north | 1 |
| b. 4 battalions in the south | 1 |
| c. Other configurations | 0 |
| 3. Reserve | |
| a. 3 battalions | 1 |
| b. Provides 2 battalion GOP task force | 1 |
| c. Other configurations | 0 |

Maximum score possible for developing the course of action was nine points.
For summary, see Table 1 at the end of this Appendix.

Task Organization and Graphic Portion of the Defense Plan

A sizable portion of this subtask was devoted to the development of the graphic portion of a defense plan. The subject drew the graphic details of the defense plan on a situation map overlay. The following information was drawn on the overlay. GOPL, Combat Outpost coordination point (COP), brigade boundaries, FDA battalion positions, reserve force location, visualized allowable enemy penetrations, blocking positions, artillery positions.

A CGSC overlay was used to score the subject's graphic responses. The values assigned to each item were as follows:

- | | Score |
|--|-------|
| 1. COP Coordinating Point (1:50,000 map) | |
| a. 1500 meters forward of the FEBA located on hills 527, 553, 543, or 547. (A deviation of \pm 500 meters from these positions were accepted). | 1 |
| b. All other locations | 0 |
| 2. Brigade boundaries (1:50,000 map) | |
| a. Lateral boundary | |
| (1) As drawn on CGSC overlay (A deviation of \pm km from school solutions was accepted). | 1 |
| (2) Other locations | 0 |
| b. Rear boundary | |
| (1) As drawn on CGSC overlay (A discrepancy of \pm 1 km from school solutions was accepted). | 1 |
| (2) Other locations | 0 |
| 3. FDA Battalion Positions (1:50,000 map) | |
| a. Battalions in the north | |
| (1) 3 battalions on the FEBA and a battalion in reserve | 1 |
| (2) Other configurations | 0 |

b. Battalions in the south	Score
(1) 3 battalions on the FEBA and 1 battalion in reserve	1
(2) Other configurations	0
4. Reserve force location (1:50,000 map)	
a. Reserve location congruent with CGSC overlay trace	1
b. Other locations	0
5. Visualized allowable enemy penetrations	
a. As indicated on CGSC overlay, or 1 km beyond CGSC trace in the northern division sector	1
b. As indicated on CGSC overlay or 1 km beyond CGSC trace in the southern division sector	1
c. Other penetration depictions	0
6. Blocking Positions (1:50,000 map)	
Only the blocking positions matching those on the CGSC overlay were counted as correct. Seventeen blocking positions were included in the school solution. Thus, the score for this item could range from zero to seventeen.	
a. Blocking positions as indicated on CGSC overlay	1-17
b. Other positions	0
7. Artillery Positions	
a. Artillery group depicted forward of the FEBA (map locations)	1
b. Not depicted forward of FEBA	0

Detailed Task Organization -- (Data Collection Forms)

The subject was requested to develop a detailed task organization of the division. Four different task organizations identified by CGSC were used to apportion weights in scoring this item. Additional scores were given to the task organizations ranked in terms of the CGSC indications of relative merit:

Task Organization I (Data Collection Forms)

GOP

- North: tank-heavy battalion and
South: infantry-heavy battalion
- Other configuration

1
0

1st Brigade

- Three infantry battalions, and
1 tank-heavy battalion
- Other configuration
- Minimum of two tank companies provided
- Less than two tank companies provided

1
0
1
0

2d Brigade

- . Three infantry battalions and
1 tank-heavy battalion 1
- . Other configuration 0
- . Minimum of one tank company provided 1
- . Less than one tank company provided 0

3d Brigade

- . Three battalion reserve 1
- . Other configuration 0
- . Tank-heavy reserve 1
- . No tanks 0
- Selection of this task organization 3

Task Organization II

- . GOP
- . North: Tank-heavy battalion and
South: Armored cavalry squadron 1
- . Other configuration 0

1st Brigade

- . 3 (-) infantry battalions 1
- . Other configuration 0
- . 1 tank-heavy battalion 1
- . Other configuration 0

2d Brigade

- . 3 (-) infantry battalions and
1 infantry battalion 1
- . Other configuration 0
- . Minimum of 1 tank company provided 1
- . Less than 1 tank company provided 0

3d Brigade

- . 3 battalions 1
- . Other configuration 0
- . Tank-heavy reserve 1
- . No tanks 0
- Selection of this organization 2

Task Organization III

GOP

- . North: infantry-heavy battalion and
South: Armored cavalry squadron 1
- . Other configuration 0

1st Brigade

- . 3 (-) infantry battalions 1
- . Other configurations 0
- . 1 tank-heavy battalion 1
- . Other configuration 0

2d Brigade

- . 3 (-) infantry battalions and 1 infantry battalion 1
- . Other configurations 0
- . Minimum of 1 tank company provided 1
- . Less than 1 tank company provided 0

3d Brigade

- . 3 battalions 1
- . Other configurations 0
- . Tank-heavy reserve 1
- . No tanks 0
- . Selection of this task organization 2

Task Organization IV

GOP

- . North: Armored cavalry squadron and South: infantry-heavy battalion 1
- . Other configurations 0

1st Brigade

- . 3 (-) infantry battalions and 1 tank-heavy battalion 1
- . Other configurations 0
- . Minimum of 2 tank companies provided 1
- . Less than 2 tank companies provided 0

2d Brigade

- . 3 (-) infantry battalions and 1 infantry-heavy battalion 1
- . Other configurations 0
- . Minimum of 1 tank company provided 1
- . Less than 1 tank company provided 0

3d Brigade

- . 3 battalions 1
- . Other configurations 0
- . Tank-heavy reserve 1
- . No tanks 0
- . Selection of this task organization 1

Artillery: Task Organization

The artillery task organization solution developed by CGSC was directly applicable to the previously defined maneuver element organizations. The artillery task organization was scored as follows:

GOP

- . 1-47 artillery and 2-631st
artillery initially assigned to the GOP 1
- . 1-47 not initially assigned to GOP 0
- . 1-48 artillery initially assigned to the GOP 1
- . 1-48 not initially assigned to GOP 0
- . A/1-439 air defense artillery (ADA)
initially assigned to GOP 1
- . A/1-439 not initially assigned to GOP 0

1st Brigade

- . 1-45th Artillery 1
- . 1-45th Artillery not assigned 0
- . B/1-439 ADA 1
- . B/1-439 ADA not assigned 0

2d Brigade

- . 1-46 Artillery 1
- . 1-46 Artillery not assigned 0
- . A/1-439 after withdrawal of GOP forces 1
- . A/1-439 not assigned after withdrawal of GOP 0

3d Brigade

- . 1-47th Artillery and 2-631st
artillery after withdrawal of GOP 1
- . 1-47th and 2-631 not assigned after withdrawal
of GOP 0

Division Artillery

- . 1-49th Honest John assigned 1
- . 1-49th Honest John not assigned DIVARTY 0
- . 1-48th after withdrawal of GOP 1
- . 1-48th not assigned DIVARTY 0

Combat Engineer: Task Organization

- . GOP - Engineer support indicated 1
- . GOP - Engineer support not indicated 0
- . 1st Brigade - engineer support indicated 1
- . 1st Brigade - engineer support not indicated 0
- . 2d Brigade - engineer support indicated 1
- . 2d Brigade - engineer support not indicated 0
- . 3d Brigade - engineer support indicated 1
- . 3d Brigade - engineer support not indicated 0

Maximum score possible for development of task organization was 50 points. For summary see Table 2 at the end of the Appendix.

Although the above scoring standards were selected to maximize scoring objectivity, judgment situations were not entirely eliminated. For example, if ADA companies were assigned to the appropriate units but company designators were not utilized, full credit was still given for the response. Partial credit was sometimes given for task organizations that appeared to be "fairly equivalent" to those recommended by CGSC.

It was occasionally necessary to review all of a subject's responses before scoring a test item. When a unit designation was unclear on a task organization form, it could often be identified by examining the subject's mission statements to subordinate units.

Table E-1

COURSE OF ACTION

Location of GOPL (1:50,000 map)	Score	Combat Power (Data Collection Form)
1. Weisse Elster River	2	1. GOP
2. 15 km forward of FEBA	1	
3. 10-12 km forward of FEBA	0	. 2 battalions 1
4. All other locations	0	. Other configurations 0
5. Omitted	0	
		2. FDA
Degree of Resistance (Data Collection Forms)		
1. 1st Bde <u>defends</u> in north		. 4 battalions in the north 1
2nd Bde <u>defends</u> in south	1	. 4 battalions in the south 1
2. 1st Bde <u>delays</u> in north		. Other Configurations 0
2d Bde <u>delays</u> in south	0	
3. 1st Bde <u>screens</u> in north		3. Reserve
2d Bde <u>screens</u> in south	0	. 3 battalions 1
4. GOP <u>forces</u> <u>delay</u>	1	. provides 2 battalions
5. GOP <u>forces</u> <u>screen</u>	0	. GOP task force 1
6. GOP <u>forces</u> <u>defend</u>	0	. Other Configurations 0
		<u>TOTAL SCORE POSSIBLE</u> 9

Table E-2

TASK ORGANIZATION - GRAPHIC PORTION OF DEFENSE PLAN

	Score	5. Visualized allowable enemy penetration
1. COPL (1:50,000 map)		
. 2500 meters forward FEBA or on Hills 527, 553, 543 or 547 (+ 500 meters allowed).	1	. Northern portion of division area in accord with school solution or 1 km beyond
. All other locations	0	. Southern portion of division area in accord with school solution or 1 km beyond
2. Brigade Boundaries (1:50,000 map)		
a. Lateral Boundary		
. As drawn on CGSC overlay (+ km either side of school solution allowed)	1	. Other visualized penetration
. Other locations	0	
3. FDA Battalion Positions (1:50,000 map)		
a. Northern battalions		
. 3 battalions at the front, 1 battalion reserve	1	. As indicated in school solution
. Other configurations	0	. Other positions
4. Location of Reserve (1:50,000 Map)		
. Located in accord with school solution	1	
. Other locations	0	
		6. Blocking Positions
		. As indicated in school solution
		. Other positions
		7. Artillery Positions
		. <u>GOB</u> (1:50,000 map)
		. Artillery Group depicted forward of FEBA

Task Organization

Task Organization I				Task Organization II				Task Organization III				Task Organization IV			
Task Organization I				Task Organization II				Task Organization III				Task Organization IV			
<div> <div>GOP</div> <div> <div>N - tk hvy bn,</div> <div>S - inf hvy bn</div> <div>Other configura-</div> <div>tions</div> </div> </div>				<div> <div>GOP</div> <div> <div>N - tk hvy bn</div> <div>S - inf hvy bn</div> <div>Other configura-</div> <div>tions</div> </div> </div>				<div> <div>GOP</div> <div> <div>N - inf hvy bn</div> <div>S - ACS</div> <div>Other configura-</div> <div>tions</div> </div> </div>				<div> <div>GOP</div> <div> <div>N - ACS</div> <div>S - inf hvy bn</div> <div>Other configura-</div> <div>tions</div> </div> </div>			
1	0	0	0	1	0	0	0	1	0	0	0	1	0	0	1
<div> <div>1st Bde</div> <div> <div>3 inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min 2 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>1st Bde</div> <div> <div>3 inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min 2 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>1st Bde</div> <div> <div>3 (-) inf bns</div> <div>Other configura-</div> <div>tions</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min 2 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>1st Bde</div> <div> <div>3 (-) inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min 2 tk Co.</div> <div>Other</div> </div> </div>			
1	0	1	0	1	0	1	0	1	0	0	0	1	0	0	0
<div> <div>2d Bde</div> <div> <div>3 inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min of 1 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>2d Bde</div> <div> <div>3 (-) inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min of 1 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>2d Bde</div> <div> <div>3 (-) inf bns,</div> <div>1 tank bn</div> <div>Other configura-</div> <div>tions</div> <div>Min of 1 tk Co.</div> <div>Other</div> </div> </div>				<div> <div>2d Bde</div> <div> <div>3 (-) inf bns,</div> <div>1 tk hvy bn</div> <div>Other configura-</div> <div>tions</div> <div>Min of 1 tk Co.</div> <div>Other</div> </div> </div>			
1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1
<div> <div>3d Bde</div> <div> <div>3 bn res</div> <div>Other configura-</div> <div>tions</div> <div>Tk hvy res</div> <div>Other</div> <div>Select this TO</div> </div> </div>				<div> <div>3d Bde</div> <div> <div>3 bns</div> <div>Other configura-</div> <div>tions</div> <div>Tk hvy res</div> <div>Other</div> <div>Select this TO</div> </div> </div>				<div> <div>3d Bde</div> <div> <div>3 bns</div> <div>Other configura-</div> <div>tions</div> <div>Tk hvy res</div> <div>Other</div> <div>Select this TO</div> </div> </div>				<div> <div>3d Bde</div> <div> <div>3 bns</div> <div>Other configura-</div> <div>tions</div> <div>Tk hvy res</div> <div>Other</div> <div>Select this TO</div> </div> </div>			
1	0	1	0	1	0	1	0	1	0	1	0	1	0	0	1

8. Artillery Task Organization		10. Engineering Task Organization	
<ul style="list-style-type: none"> . 1-47, 2-631 initially to GOP . 1-47, 2-631 not to GOP . 1-48, initially to GOP . 1-48, initially not to GOP . A/1-439 ADA initially to GOP . A/1-439 ADA not to GOP 	<ul style="list-style-type: none"> 1 0 1 0 1 0 	<ul style="list-style-type: none"> . Support indicated . Support not indicated 	<ul style="list-style-type: none"> 1 0
First Brigade		First Brigade	
<ul style="list-style-type: none"> . 1-45th assigned . 1-45th not assigned . B/1-439 AIA assigned . B/1-439 AIA not assigned 	<ul style="list-style-type: none"> 1 0 1 0 	<ul style="list-style-type: none"> . Support indicated . Support not indicated 	<ul style="list-style-type: none"> 1 0
Second Brigade		Second Brigade	
<ul style="list-style-type: none"> . 1-46th assigned . 1-46th not assigned . A/1-439 after GOP . A/1-439 not assigned after GOP 	<ul style="list-style-type: none"> 1 0 1 0 	<ul style="list-style-type: none"> . Support indicated . Support not indicated 	<ul style="list-style-type: none"> 1 0
Third Brigade		Third Brigade	
<ul style="list-style-type: none"> . 1-47, 2-631 after GOP . 1-47, 2-631 not assigned after GOP 	<ul style="list-style-type: none"> 1 0 	<ul style="list-style-type: none"> . Security considered . Security not considered 	<ul style="list-style-type: none"> 1 0
9. Division Artillery		11. Rear Area	
<ul style="list-style-type: none"> . 1-49 assigned . 1-49 not assigned . 1-48 after GOP . 1-48 not assigned after GOP 	<ul style="list-style-type: none"> 1 0 1 0 		
		TOTAL SCORE POSSIBLE	50
		<u>SUMMARY</u>	
		Course of Action	- 9
		Task Organization	-50
		TOTAL POSSIBLE SCENARIO SCORE	59

APPENDIX F QUANTIFICATION OF DEFENSIVE SCENARIO INFORMATION CONTENT

DEVELOPMENT OF FACT SCORE

During the first experiment in this series, an attempt was made to quantify the information appearing in the various information displays. On the basis of an analysis of the data, it was determined that the better decision makers gained access to specific items of information which were not used by the other scenario participants. As a result, these information items were termed relevant facts. A similar procedure was used with the current study to develop a FACT score for each subject.

The procedure for quantifying the information in each display was rather global in nature. No attempt was made to develop quantification along lines defined by current information theory. For example, viewing an index would likely reduce uncertainty to some extent. However, a zero information designation was assigned to each index in the scenario on the assumption that very little in the way of tactical information could be gained from the indexes themselves. Thereafter, one score point was assigned for each simple sentence that conveyed a single thought and for each grouping of alpha-numeric data that conveyed a single thought. Several examples of information displays and their attendant FACT scores are presented below:

FACT = 0	(1) G1 PERSONNEL	(6) FIRE SUPPORT (FSCE)
	(2) G2 INTELLIGENCE	(7) CHEMICAL (CBRE)
	(3) G3 OPERATIONS	(8) SIGNAL
	(4) G4 LOGISTICS	(9) TRANSPORTATION
	(5) G5 CIVIL AFFAIRS	(0) ENGINEER

FACT = 0	G1 REPORTING SIR. G1 INFORMATION IS ORGANIZED AS FOLLOWS:	
	(1)	PERSONNEL AUTHORIZED
	(2)	PERSONNEL EFFECTIVE PERCENT
	(3)	PERSONNEL MANAGEMENT
	(4)	DEVELOPMENT AND MAINT OF MORALE
	(5)	PERSONNEL SERVICES
	(6)	MAINT OF DISCIPLINE LAW AND ORDER
	(7)	GRAVES REGISTRATION

FACT = 1	PERSONNEL AUTHORIZED 20 MECH DIV		
	OFF	EM	TOTAL
	1152	16959	18111

PERSONNEL AUTHORIZED 2d BDE

FACT - 1	OFF	EM	TOTAL
	196	3789	3985

PERSONNEL STATUS 1-68 MECH BN

FACT - 1	OFF	EM	TOTAL
	31	697	728

ELECTRONIC EQUIP STATUS 1-68 MECH

FACT - 3

100 PERCENT OF TOE ELECTRONIC EQUIP.

91 PERCENT SERVICEABLE. EXPECT EQUIP TO BE

100 PERCENT COMBAT READY WITHIN 48 HOURS.

UNIT ORGANIZATION

1-69 MECH BN

FACT - 1

HHC

A/1-69 MECH

B/1-69 MECH

C/1-69 MECH

CURRENT ACTIVITIES 1-69 MECH BN

FACT - 2

IN ASSEMBLY AREA CONDUCTING ROUTINE TRAINING

ON THE USE OF CREW SERVED WEAPONS.

CURRENT ACTIVITIES 1-68 MECH BN

FACT - 2

IN ASSEMBLY AREA CONDUCTING ROUTINE TRAINING

ON USE OF CREW SERVED WEAPONS.

WEAPONS STATUS 1-68 MECH BN

FACT - 3

100 PERCENT OF TOE WEAPONS. TWO RIFLES (RECOILESS, 106MM), AND TWO 81MM MORTARS ARE IN DIV MAINTENANCE. . EXPECT WEAPONS TO BE 100 PERCENT READY FOR DEPLOYMENT WITHIN 48 HOURS.

MOBILITY EQUIP STATUS 1-68 MECH BN

FACT - 3

100 PERCENT OF TOE MOBILITY EQUIP.

90 PERCENT SERVICEABLE. EXPECT EQUIP TO
BE 100 PERCENT COMBAT READY WITHIN 48 HOURS.

UNIT LOCATION 1-69 MECH BN

FACT - 1

VIC MAINLEUS (PA7052)
